PROBLEM STATEMENT
FOR THE IMPERIAL VALLEY DRAINS SEDIMENTATION/SILTATION TMDL

The Imperial Valley drains are listed as impaired by sediment on the State of California's Clean Water Act Section 303(d) List. Accordingly, a Sedimentation/Siltation Total Maximum Daily Load (TMDL) is proposed for the Imperial Valley drains, by the California Regional Water Quality Control Board, Colorado River Basin Region (Regional Board). This Problem Statement for the Imperial Valley drains TMDL includes a description of: (a) water quality objectives and beneficial uses, (b) watershed characteristics that contribute to sedimentation/siltation, and (c) impairments caused by sedimentation/siltation.

A. WATER QUALITY OBJECTIVES AND BENEFICIAL USES

Narrative water quality objectives for sediment, suspended solids, and turbidity were established by the Regional Board to protect beneficial uses of waterways in the Region. Violations of water quality objectives would indicate that beneficial uses are impaired. Tables 3.1 and 3.2 summarize water quality objectives (which apply to all surface waters in the Region), and beneficial uses specific to the Imperial Valley drains.

Table 3.1: Water Quality Objectives

Parameter	Water Quality Objective
Sediment	The suspended sediment load and suspended sediment discharge rate to surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
Suspended Solids	Discharges of wastes or wastewater shall not contain suspended or settleable solids in concentrations which increase the turbidity of receiving waters, unless it c□n be demonstrated to the satisfaction of the Regional Board that such alteration in turbidity does not adversely affect beneficial uses.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.

(California Regional Water Quality Control Board 2002)

Table 3.2: Beneficial Uses of the Imperial Valley Drains

Beneficial Use	Description
Warm Freshwater Habitat (WARM)	Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
Wildlife Habitat (WILD)	Uses of water that support terrestrial ecosystems including, but not limited to, the preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), water, and food sources.
Preservation of Rare, Threatened, and Endangered Species (RARE)	Uses of water that support habitats necessary, at least in part, for the survival and successful mainte□ance of plant or animal species established und□r state or federal law as rare, threatened or endangered.
Contact Recreation (REC I)	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, and use of natural hot springs. **Note:** For Imperial Valley drains, the only known REC I usage is infrequent fishing, which is unauthorized.
Non-Contact Recreation (REC II)	Uses of water for recreational activities involving proximity to water, but not normally involving contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment of the above activities. **Note:** For Imperial Valley drains, such activity is unauthorized.
Freshwater Replenishment (FRSH)	Uses of water for natural or artificial maintenance of surface water quality or quantity.

(California Regional Water Quality Control Board 2002)

B. WATERSHED CHARACTERISTICS

Hydrogeological Setting

The main source of sediment to the Imperial Valley drains is agricultural runoff from farmland. Imperial Valley drains are owned and operated by the Imperial Irrigation District. A 1,668-mile system of main and lateral canals delivers water to 500,000 acres of Imperial Valley farmland (Imperial Irrigation District 1998). Agricultural tailwater that exits the farmland is conveyed by about 1,500 miles of drains into the Alamo River or New River (and eventually into the Salton Sea), or into the Salton Sea directly. This TMDL covers about 200 miles of drains, all of which empty directly into the Salton Sea. Nearly all (98%) of IID-transported water is used for

agriculture, with a relatively small amount (2%) used for drinking water for nine Imperial Valley cities (Imperial Irrigation District 1998).

Most sediment in drains is due to tailwater, which is applied irrigation water that does not percolate into soil, thereby exiting at the lower end of the field, into an IID drain. This agricultural runoff travels from drains into the Alamo River or New River (and eventually the Salton Sea), or into the Salton Sea directly. Stormwater and urban runoff account for a relatively small amount of discharge to the drains. Wastewater treatment facilities do not discharge into the drains at all. Table 3.3 summarizes flow sources and percent flow contribution for Imperial Valley drains.

Table 3.3: Imperial Valley Drains -- Flow Sources and Percent Flow Contribution

Flow Source	Percent (%) Flow Contribution
Agricultural runoff	99
Stormwater and urban runoff	1
Wastewater treatment facilities	0

Soil Classifications

Local soils are mostly colloidal clays and silts (Table 3.4). These soils tend to be cohesive, and therefore not easily erodable. This is evident in that the channels of Imperial Valley drains remain relatively stable. Therefore, instream erosion is believed to be a relatively minor source of suspended sediment.

Table 3.4: Imperial Valley Soil Associations

Soil Association	Description	Composition	Slope	Permeability
Imperial	Moderately well-drained silty clay. Very deep, calcareous soils. Natural drainage has been altered by irrigation canal seepage and extensive irrigation.	85% Imperial soils 15% minor soils	< 2%	Low
Imperial-Holtville-Glenbar	Moderately well-drained silty clay, silty clay loam, and clay loam. Very deep calcareous soils. Natural drainage has been altered by irrigation canal seepage and extensive irrigation.	40% Imperial soils 20% Holtville soils 20% Glenbar soils 20% minor soils	< 2%	Low
Meloland-Vint-Indio	Well-drained fine sand, loamy very fine sand, fine sandy loam, very fine sandy loam, loam and	30% Meloland soils	<2%	Low

	silt loam. Very deep, calcareous soils. Natural drainage has been altered by irrigation canal seepage and extensive irrigation.	25% Vint soils 20% Indio soils 25% minor soils		

(Zimmerman 1981)

C. IMPAIRMENT BY SEDIMENT

Recent sediment data, represented by total suspended solids (TSS) and turbidity, exists on only a few of the larger Imperial Valley drains. This data does not indicate sediment impairment. However, Regional Board staff is concerned about the Imperial Valley drains because:

(a) not much data exists.

(b) farming practices along these drains are similar to those along the New River and Alamo River, which do carry a high sediment concentration as indicated by TSS and turbidity measurements.

(c) data shows that TSS and turbidity are higher at the downstream end of the drain system, and are at the same levels found in the Alamo River and New River.

Regional Board staff prefers that the entire Imperial Valley be in compliance with the same sedimentation/siltation standard, as represented by a Total Maximum Daily Load numeric target. The Alamo River sedimentation/siltation TMDL was adopted by the Regional Board, and approved by the State Water Quality Control Board, Office of Administrative Law and USEPA in May 2002. The New River sedimentation/siltation TMDL was adopted by the Regional Board in June 2002, and is currently under review by the State Water Quality Control Board.

Sediment as an Impairment to Aquatic and Terrestrial Organisms

Excess sediment in the water column and in bottom deposits threatens many aquatic and terrestrial organisms that utilize Imperial Valley drain habitat, as well as habitat downstream of the drains. Diversity is reduced as sediment-sensitive species disappear.

In the water column, excess sediment can: (1) clog fish gills, causing death or inhibiting growth, (2) prevent successful development of fish eggs and larvae, (3) modify natural fish movements and migration, and (4) reduce food abundance available to fish. Excess sediment in the water column also can: (1) reduce light penetration, which reduces the ability of algae to produce food and oxygen, (2) affects other parameters such as temperature, and (3) interferes with mixing, which decreases oxygen and nutrient dispersion to deeper layers.

In bottom deposits, excess sediment can: (1) smother bottom-dwelling organisms, (2) cover breeding areas, and (3) smother eggs. Excess bottom sediment in riparian habitat can bury tree and shrub roots, as well as reeds, cattails, and arrowheads used for food and cover. Riparian areas constitute sensitive habitat, as they provide important habitat for songbirds and serve as potential wildlife movement corridors. Excess bottom sediment in wetland habitat can choke out plants that are used for food and cover, and can drastically reduce the health and numbers of organisms (e.g., plankton, detritus, aquatic vegetation) at the base of the food web. Wetland areas, as part of the Salton Sea delta, are a critical stop for migrating birds on the ecologically

important Pacific Flyway, a major migratory route connecting Canada and the U.S. to Mexico and Central America.

Sediment as a Carrier for DDT, DDT Metabolites, and Toxaphene

Imperial Valley has one of the highest maximum Total DDT concentrations in the Colorado River Basin Region (Table 3.5) and the State of California (State Water Resources Control Board 1978-1995). Total DDT concentrations in fish tissue routinely exceed the National Academy of Sciences (NAS) recommended maximum concentration (State Water Resources Control Board 1978-1995) and the U.S. Food and Drug Administration (FDA) Action Level. (NAS guidelines are meant to protect species that consume DDT at all food chain levels. FDA Action Levels are meant to protect humans from chronic effects of DDT consumption, and are based on consumption quantity and frequency.)

Table 3.5: DDT Data by Surface Water for the Colorado River Basin Region

Station Location	Number of Samples	Number of Organisms	Number Exceeding NAS Criteria	Number Exceeding FDA Action Level	Max (Ppb, Wet Weight)	Mean (Ppb, Wet Weight)	90th Percentile (Ppb, Wet Weight)
Imperial Valley	116	848	41	6	9153	1251	3308
Alamo River (all stations)	27	137	21	5	9153	2816	5468
Alamo River/ International Boundary	4	56	3	0	1371	955	1305
Alamo River/ Holtville	1	3	0	0	515	515	
Alamo River/ Brawley	1	3	0	0	460	460	
Alamo River/ Calipatria	21	75	17	5	9153	3392	5517
New River (all stations)	34	176	12	0	3368	1090	2584
New River/ International Boundary	8	85	1	0	1209	539	825
New River/ Westmorland	26	91	11	0	3368	1259	2687
Agricultural Drains	30	399	9	1	5106	1087	3324
Salton Sea	21	102	0	0	276	97	180
Fig Lake	7	40	0	0	592	145	321
Wiest Lake	1	4	0	0	38	38	
Salt Creek Slough	3	6	1	0	3319	1193	
Coachella Valley Stormwater Channel	7	84	2	0	2883	1224	2695
Palo Verde Outfall Drain	9	45	1	0	1475	354	632
Colorado River (all stations)	17	90	0	0	855	102	165
Colorado River/ Needles	3	12	0	0	77	38	
Colorado River/ Pichaco	2	11	0	0	46	28	
Colorado River/ Upstream of Imperial Dam	3	21	0	0	27	15	
Colorado River/ Cibola	6	34	0	0	175	96	
Colorado River/ International Boundary	3	12	0	0	855	313	

(State Water Resources Control Board 1978-1995)

DDT (Dichlorodiphenyl trichloroethane) was a widely used insecticide in the United States between 1942 and 1973. DDT breakdown products include the metabolites DDE (Dichlorodiphenyl dichloroethylene) and DDD (Dichlorodiphenyl dichloroethane). The sum of DDT, DDE, and DDD commonly are referred to as "Total DDT." DDT, DDE, and DDD are known carcinogens listed in the Governor's Proposition 65 List of Chemicals Known to the State of California to Cause Cancer or Reproductive Toxicity. DDT is also a recognized developmental toxicant. DDT was banned in the United States in 1973 and in Mexico in 1983.

DDT was used extensively in Imperial Valley as a low-cost, broad-spectrum insecticide (Setmire et al. 1993). The pesticide dicofol, currently in use in Imperial Valley, contains DDT and may contribute DDT metabolites to Imperial Valley. Studies in other areas of California show that DDT breakdown products have a very long lifetime in agricultural fields with clay soils (California Department of Food and Agriculture 1985), like the soils in Imperial Valley.

DDT and its metabolites are organochlorine pesticides with low water solubility. As such, they have a propensity to attach to negatively-charged clay-rich sediments, like those in Imperial Valley. Therefore, sediment-laden agricultural runoff serves as the transport mechanism by which DDT compounds adhering to soil are introduced to the drain water system. DDT metabolites have been detected in bottom sediment samples in Imperial Valley waterways (Setmire et al. 1990, Setmire et al. 1993, Eccles 1979).

DDT and its metabolites have a high propensity to store themselves in body fat, especially in the central nervous system, liver, and kidneys. In these organs, organochlorine pesticides damage important enzyme functions and disrupt biochemical cell activity (U.S. Environmental Protection Agency 1989). These properties allow DDT and its breakdown products to bioaccumulate in fish and wildlife, with severe consequences for wildlife at the top of the food chain. DDT effects on birds and aquatic organisms are well-documented by scientists throughout the world. Adverse effects include egg thinning, egg breakage, decreased egg productivity, decreased hatching and fledging success, decreased nesting success, chick mortality during hatching, and death (Kaloyanova and El Batawi 1991).

Fish and bird specimens from the Imperial Valley routinely have some of the highest DDE concentrations in California (State Water Resources Control Board 1978-1995, U.S. Environmental Protection Agency 1980, Ohlendorf and Miller 1984, Mora et al. 1987, Setmire et al. 1993). Some of the highest concentrations were found in birds feeding in agricultural fields on invertebrates and other food items (Setmire et al. 1993).

Reproductive success of colonial nesting birds has declined at the Salton Sea, likely due to high levels of multiple contaminants, particularly organochlorine pesticides, in eggs (Bennett 1998). DDE-caused reproductive depression in birds has emerged as a serious concern in the Salton Sea area. Resident birds typically had higher DDE concentrations than migratory species. The endangered California brown pelican, threatened bald eagle, and endangered peregrine falcon, among others, are exposed to DDE levels that pose a high concern level and an increased risk of adverse effects (Setmire et al. 1993). People who consume fish from Imperial Valley waterways also are at risk.

The Imperial Valley also has the highest maximum toxaphene concentration in the Colorado River Basin Region (Table 3.6). Toxaphene, like DDT, is an organochlorine chemical with low water solubility, a propensity to attach to soil particles, and a tendency to bioaccumulate in fish and wildlife. Toxaphene has a half-life in soil of up to 14 years (Genium Publishing Corporation 1999), has high chronic toxicity to aquatic life (U.S. Environmental Protection Agency 1989), and is a recognized Proposition 65 carcinogen. USEPA canceled all registered toxaphene uses in 1983 (Ware 1991).

Table 3.6: Toxaphene Data by Surface Water for the Colorado River Basin Region

Station Location	Number of Samples	Number of Organisms	Number Exceeding NAS Criteria	Number Exceeding FDA Action Level	Max (Ppb, Wet Weight)	Mean (Ppb, Wet Weight)	90th Percentile (Ppb, Wet Weight)
Imperial Valley	117	853	51	0	3400	323	940
Alamo River (all stations)	27	137	20	0	2200	571	1588
Alamo River/ International Boundary	4	56	3	0	300	198	288
Alamo River/ Holtville	1	3	0	0	0	0	
Alamo River/ Brawley	1	3	0	0	0	0	
Alamo River/ Calipatria	21	75	17	0	2200	697	1870
New River (all stations)	35	181	17	0	3400	333	810
New River/ International Boundary	8	85	0	0	0	0	0
New River/ Westmorland	27	96	17	0	3400	431	858
Agricultural Drains	27	393	14	0	2800	399	1128
Salton Sea	21	102	0	0	0	0	0
Fig Lake	7	40	0	0	0	0	
Wiest Lake	1	4	0	0	0	0	
Salt Creek Slough	3	6	0	0	0	0	
Coachella Valley Stormwater Channel	7	84	3	0	440	133	368
Palo Verde Outfall Drain	9	45	2	0	1200	148	344
Colorado River (all stations)	17	90	0	0	0	0	
Colorado River/ Needles	3	12	0	0	0	0	
Colorado River/ Pichaco	2	11	0	0	0	0	
Colorado River/ Upstream of Imperial Dam	3	21	0	0	0	0	
Colorado River/ Cibola	6	34	0	0	0	0	
Colorado River/ International Boundary	3	12	0	0	0	0	

(State Water Resources Control Board 1978-1995)

Therefore, the Regional Board is proposing a sedimentation/siltation TMDL for Imperial Valley drains to address the 303(d) listing, achieve water quality objectives, and protect beneficial uses. Approval of this TMDL will bring the entire Imperial Valley into compliance with a uniform sedimentation/siltation standard.

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